

**14.1 Electronic vs electrical devices**

<p><b>■ Electronic</b></p> <ul style="list-style-type: none"> <li>□ Made with semiconductors (silicon)</li> <li>□ Tiny &amp; need low-intensity so that information can be controlled.</li> <li>□ Component examples                     <ul style="list-style-type: none"> <li>■ Diodes</li> <li>■ Transistors</li> </ul> </li> <li>□ Computers, phones</li> </ul>	<p><b>■ Electrical</b></p> <ul style="list-style-type: none"> <li>□ Made with conductors (metals (copper) &amp; alloys)</li> <li>□ Larger &amp; powerful circuits &amp; motors.</li> <li>□ Component examples                     <ul style="list-style-type: none"> <li>■ Wires</li> <li>■ Switches</li> <li>■ Fuses</li> </ul> </li> <li>■ Toaster, stove</li> </ul>
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**Please Write**

**14.2 Electrical Circuits**

**■ CONVENTIONAL CURRENT** Conventional flow notation

- Flows from + to -

**■ ELECTRON FLOW**

- Flows from - to +

Electric charge moves from the positive (surplus) side of the battery to the negative (deficiency) side.

- Circuit diagrams place their components (parts) to follow the direction of **conventional current!**
- Make a table "Circuit Symbols" with 3 columns
  - Component
  - Symbol
  - Function

**Please Write**

**Circuit Symbols**

Component (part)	Symbol (s)	Function (how it controls current)
We will fill this up as we go! Leave 20 rows please 😊		

**14.3 Power Supplies**

- Provide the energy to cause current to move thru a circuit.
- Two types of current:
  - DC = Direct Current
    - Electrons move continuously in one direction.
    - More powerful
    - Eg. battery
  - AC = Alternating Current
    - Electrons move back and forth.
    - Easier to transport.
    - Eg. From power plants.

**Please Write**


**Symbols for power supplies  
please add to table**

Component:	Symbol	Function
■ Battery		Power Supply
■ Alternating current AC		Power Supply
■ Direct current DC		Power Supply
■ Photoelectric Cell		

Please Write

### AC electrical generators

- Turns mechanical energy into electrical energy.
  - Makes AC current!
  - Using a rotating magnetic field with a stationary armature

Or I am an armature → 

- rotating armature with a stationary magnetic field

- Driven by:
  - Combustion engine = Alternator (in a car)
  - Permanent magnets = Magneto
  - Steam engine (power plant) = Turbo-alternators

Please Write

	Advantages	Disadvantages
Battery (chemical E → electrical E)	Portable	Must be replaced Environmental Hazard
Electrical Outlet	Stable source	Close proximity
Photovoltaic cell (sun E → electrical E)	Portable Long lasting	Weather dependant Expensive

## 14.4 Conduction, insulation & protection

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Please Write

### Conductors:

- Are materials that allow the movement of current through a circuit.
- **Conduction:** is the movement of current through a conductor (copper wire).
- Ex:
  - Copper,
  - aluminum,
  - Silver,
  - optical fibers.

Please Write

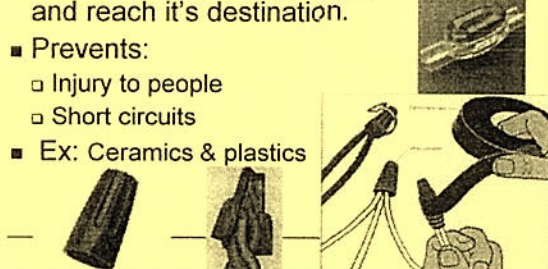
### Printed Circuits:

1. Board = thin plastic sheet.
2. Cover with a thin copper sheet.
3. A circuit is etched in.
4. Extra copper is removed. (by leaching)
5. Electric & electronic components are then soldered on.

Please Write

### Insulation:

- Function: to prevent current flow!
- Allows current to stay within the wire and reach it's destination.
- Prevents:
  - Injury to people
  - Short circuits
- Ex: Ceramics & plastics



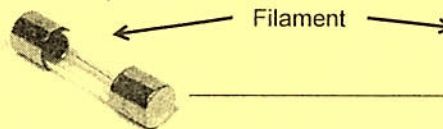
## Protection: Please Write

- Components that stop current if there is a short circuit or a power surge.
- Ex:
  - Fuse
  - Circuit breakers

## Fuses:

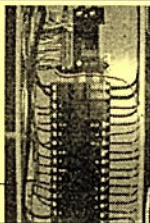
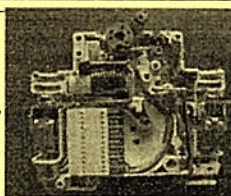



- Regulate the amps allowed to pass thru a circuit.
- The current can pass thru the filament.
- If the current intensity (amps) is too high, the filament melts then breaks.
- You must replace it.



## Breaker

- How it works:
  - When the current intensity gets too high....
  - The bimetallic strip heats up & bends.
  - As it bends the connection is broken and snaps to the off position.
  - You then go to your breaker panel and reset the switch to on.

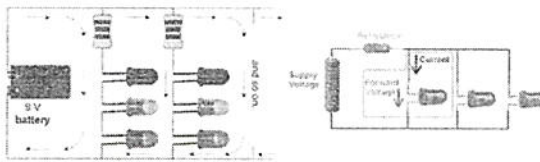


Component	Symbol	Function
Fuse or Breaker		Protection

**Please Write onto table**

**Please Write**  
**14.5 ELECTRICAL RESISTANCE (EST/AST)**

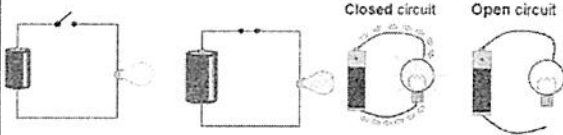
- Resistors limit the current flow through a circuit.
- You can add or remove resistors to meet the needs of you component.



- Refer to you Ch5 notes for reading resistors.  $\Omega$

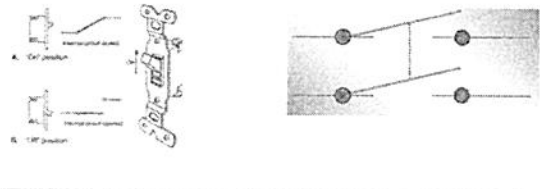
**14.6 Control** **Please Write**

- The "Control" function is the ability to open or close a circuit.
  - Closed circuit = has electricity flowing in a loop.
  - Open circuit = does not have electricity flowing (due to an opening in the wires).
- Eg. switches & pushbuttons



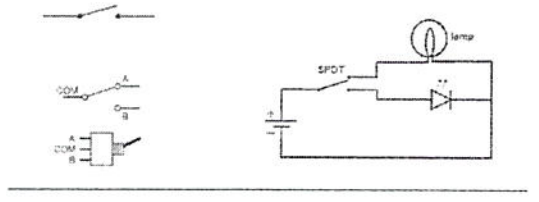
**Types of Switches** **Please Write**

- Pole = # of contact points it can open/close at once
  - Single-pole = open/close one contact at a time
  - Double-pole = open/close two contacts at a time








**Please Write**

- Throw = # of paths that the electrons can flow in.
  - Single-throw = electrons may only follow one path
  - Double-throw = once the switch is closed .... Electrons have a choice of two paths

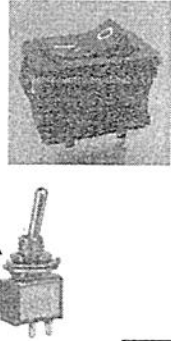


**Add to table please**

Component	Symbol	Function
Single-pole Single-throw switch		Control
or		
Double-pole Single-throw switch		Control
Single-pole Double-throw switch		Control
Double-pole Single-throw switch		Control

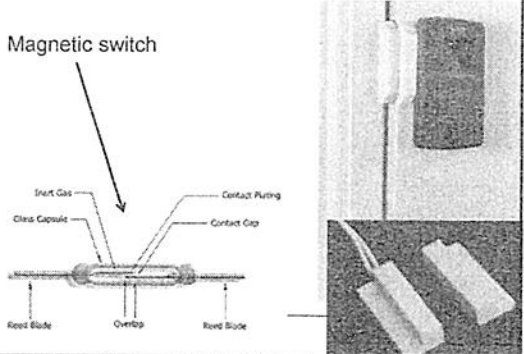
Examples Please Write

- Single-pole double throw
  - Rocker switch
  - Toggle switch



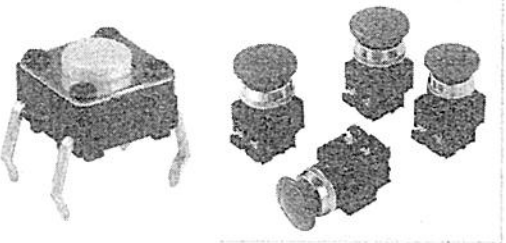
Other examples: Please Write

- Magnetic switch



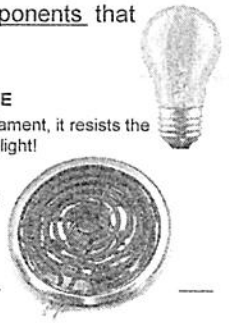
Please Write

- Push button




**14.7 Energy Transformation (ST/EST/AST ONLY)**

- Changes one form of energy into another.
- Examples of electrical components that transform electricity:
  - Incandescent bulbs
    - Turns electrical E → luminous E
    - Current flows thru a tungsten filament, it resists the current & heats up until it emits light!
  - Heating element
    - Turns electrical E → thermal E
    - Ex: ovens & kettles



Please Write

- Piezoelectric crystals
  - Turns electrical E → mechanical E (or sound E)
  - Current causes the crystals to vibrate
  - Ex: watches & speakers
- Electromagnets
  - Turns electrical E → magnetic E
  - Current flows through a coil creating a magnetic field
  - Ex: old tape recorders & electromagnets



Please Write

### 14.7 Components with other functions (EST/AST ONLY) Please Write Title

- CAPACITORS
- DIODES
- TRANSISTORS (AST ONLY)
- RELAYS (AST ONLY)

## CAPACITORS Please Write

- Store electrical charge.
- Made of 2 metal plates separated by an insulator (dielectric).
- Charge builds up on one plate, when the insulator is removed ... the charge is released.
  - Ex: Camera flash
  - Voltage stabilizer

## Diode Please Write

- Allows current to flow in one direction.
- Is made of semiconductor material (silicon)
- Roles
  1. Guides the direction of current.
  2. Protects circuits from current flowing the wrong way
    - Someone inserted a battery backwards!
  3. Rectifies current (changes AC to DC)
  4. LED = light emitting diode
    - Visually tells you what way the current is flowing.
    - Emits a lot of light with low voltage.

Component	Symbol	Function
DIODE		Protect circuits, guide current flow & rectify AC to DC
LED		All of the above & produce light
Capacitor		Stabilizes current

**Please Write onto table**


## Transistors (AST ONLY) Please Write


- Block or amplify current
- Parts:
  - Collector
  - Emitter
  - Base
- Current goes from the collector → emitter → base
- The base act as a door
  - It is controlled by a weak current



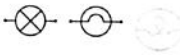
## Relays (AST ONLY) Please Write

- A relay opens/closes a circuit using an electrical signal from another circuit.

- The signal can come from :
  - another computer
  - Closing a switch
  - Photoelectric cell (yard light)
- Has 2 parts:
  - 1 Receives signal & sends command **Please Write**
  - 2 Receives command & starts 2<sup>nd</sup> circuit
- EX:
  - High voltage circuits controlled from a safe distance
  - Theater lighting
  - X-ray machines





Component	Symbol	Function
Transistor		Blocks/amplifies current
Relay	depends on type	Electrical switch
Resistor		Regulates current
Light (non LED)		Illuminates

**Please Write onto table – others on p460**